The Maryland Fruit Grower

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MAKING THAT CIDER

For many very good reasons, the human stomach craves the tang, bouquet, sweetness, soothing satisfaction and healthy qualities of good old apple cider. Much work has been done on methods of making a real product, and attempts have been made to open up some trade outlets for cider, but in spite of all these attempts, and with some very fine products, this market has not developed and seems still a fertile field for development. Apple juice is a little difficult to handle, as it contains some materials that, if left in, will cause cloudiness, and if removed too completely, will affect flavor. Heating may cause a "cooked" flavor, and chemical preservatives may cause bitterness. It has been found that freezing apple juice to 10° below zero, will preserve it for a year or two, and not affect flavor.

There is still a considerable demand for the old-time "run of the mill" cider but filtered cider is coming into use, and it does look much more palatable than the unfiltered product.

Remembering that cider is for human consumption, and also that bacteria, molds or chemical action may affect color or taste, the fruit should be washed before pressing, and the press and utensils should be kept clean. Rot spots do not add anything pleasant to the flavor of the cider. Circular No. 149, published by New York Agricultural Experiment Station, Geneva, N. Y., gives fine suggestions on cider making.

Some varieties make better cider than others, and blends of variety flavors add to cider quality. Farmers' Bulletin 1264*, "Farm Manufacture of Unfermented Apple Juice" classifies apples in groups according to their cider making qualities:

Group 1—Sweet sub-acid group—Baldwin, Hubbardtson, McIntosh, Fameuse, Northwestern, Rome and Stark. Juice sweet and of good flavor, but lacks tartness and acidity.

Group 2—Mildly acid to slightly tart—Winesap, Jonathan, Yellow Newtown, Stayman, Northern Spy, Wealthy and York. Any of these are good for a single-variety cider or good for blending with the sweet sub-acid group listed above, to give tart flavor. Other varieties, not widely grown in the Maryland section, but good for cider are: Arkansas Black, Lawver, Missouri Pippin, Rhode Island Greening, Twenty Ounce and Yellow Bellflower.

Group 3—Aromatic—Delicious, Golden Delicious, Winter Banana, Roxbury, McIntosh and Bonum. Juices not so well balanced in sugar and acid content, but highly desirable for adding to the other juices (group 2) as a

* For sale by Superintendent of Documents, Washington, D. C., 10c per copy.

blend, to add aroma and flavor. About 5 to 10% of such juice is added to the other juice.

Group 4—Astringent—Crab apples are used by some growers in making cider blends, adding about 3 to 5% of such juice to mixtures of Groups 1 or 2 to give a tang to the cider.

Group 5—Neutral—Ben Davis, Gano, Willowtwig, Missouri Pippin, Alexander and Wolf River. Poor quality for cider. May be used for bulk, but should be balanced by adding juice of aromatic (Group 3) and mildly acid (Group 2) varieties to give flavor.

Where such actual mixing of juices is impossible, much the same effect is obtained by mixing the varieties as they are ground and pressed.

Having washed and pressed the fruit, and blended the flavors, the next steps should be some type of clarification. There seems to be no real way of clarifying the juice unless filtration is used some place in the process. The enzyme "pectinol" may be used adding 16 to 20 ounces of the material to 100 gallons of cider, allowing the cider to stand overnight before filtering. Or the enzyme may be added and the cider heated to 180°F and filtered after 3 hours standing, to cool. Another clearing process is the use of 1.25 ounces of tannin per 100 gallons of cider, followed by 3 to 4.5 ounces of gelatin per 100 gallons of cider. Then comes filtering, and there are all sorts of filters. One simple form of filter used by several growers with rather good results, is that developed at Michigan Agricultural Experiment Station. The process as described uses pectinol. Some Maryland growers have used the method without the enzyme, and had rather good results. Trial of both methods will help each grower to determine which is best under his conditions. The details of the Muslin Tube Fruit Juice Filter are given:

HICKOK, R. B., and MARSHALL, ROY E. Michigan State College, Agricultural Experiment Station, "The Quarterly Bulletin," February, 1933, pp. 191-197.

"Following the development of a practical method for producing a brilliantly clear and transparent apple cider by the New York Agricultural Experiment Station, the Michigan Station showed that consumer demand may be very substantially increased by offering the public this cider rather than the ordinary cloudy, opaque product at price differentials of five to ten cents per gallon. Records of sales at the Michigan State College during the fall of 1932 fully duplicated those of the previous season. There were very few calls for the untreated cider, though it was always available at five cents per gallon less at the College and 10 to 12 cents per gallon less at the Lansing City Market.

The Home-made Filter

The set-up for performing the filtering operation consists of three principal parts:

1. A mixing and supply tank.
2. Elevation of the supply tanks to provide a pressure head on filter unit.
3. The collecting or filtering unit.

The collecting unit is the novel and most essential part of the outfit. It is a long, slender, cloth tube, closed at one end, with the other end connected to a rubber hose extending from the supply tank. This tube is laid

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in a horizontal position in a trough. When the mixture of cider and filter aid is fed into the closed tube, the pressure swells the tube to its full dimensions. The cider is forced out rather uniformly over the entire surface of the tube and the filter aid forms a cake of uniform thickness on the inside. The trough is given a slight slope so that the clear juice runs out of one end into a receptacle.

The cloth tube is made of unbleached muslin, sewed to give a diameter of approximately three inches. A tube of a larger diameter will not support the filter cake satisfactorily and subsequent cracking and breaking of the cake may cause cloudiness in the filtered cider. A tube one yard long is most convenient. It cleans easily, coats evenly in a short time, and is the usual cloth width sold. It is recommended that both ends of the tube be left open to facilitate cleaning. In use, the dead end should be folded back, carefully gathered and tied, preferably with a single miller's knot.

The tube should be supported in the trough by a copper screen. This allows free flow from the trough and makes the entire area of the tube effective in filtering. The copper screen is preferable to iron wire screen because it is less affected by fruit juices.

It is necessary to have a small pressure head on the filter. This can be satisfactorily secured by elevating the supply tank. The greater the elevation the more rapid the flow will be from the filter. The net head should not exceed 15 feet (with muslin tube) and eight feet results in very satisfactory operation. Less head may be used where small quantities are to be filtered, but will necessitate more frequent cleaning of the collector. Tests with cider subjected to enzymic clarification gave the following rates of filtration:

Net Head (Ft.)	Gallons per Minute *
4	.65
6	1.05
8	1.43
10	1.80
12	2.50
14	3.34

The necessary head may be obtained in different ways: 1. The supply tank may be put on the floor of the upper story of a building and the filter below; 2. a platform may be constructed to support the supply tank at the desired height; 3. or the tank may be raised and lowered by a black and tackle or chain fall. Where a large amount of filtering is to be done, it may be more economical to use a pump ** in connection with a storage tank. A pump may be directly connected to the filter, in which case it should be provided with a pressure control. For farm purposes, the cider can be carried or hand-pumped to the height of the supply tank.

The supply and mixing tank should be of wood. A barrel, with the head removed for filling and mixing, may be used where small quantities of cider are handled. Delivery to the filter should be through a rubber garden hose, preferably five-eighths inch in diameter. The tank or barrel may be bored and fitted with a brass spigot, or the cider may be siphoned from the barrel. It is convenient to have a cut-off in the delivery hose. A convenient arrangement is a ½ inch gate valve at the lower end, fitted with two nipples. One

* These were for short runs of about five gallons and rate would be lower for longer runs with thicker filter cakes.

** Where a pump is used, it should be of bronze and with a minimum of metal in contact with the cider.

⅜ inch nipple with bushing will fit into the inside of the hose and the filter tube can be attached to the other. This arrangement is convenient for shutting off the flow to clean the unit and for starting the siphon. The muslin tube should be wrapped tightly around the nipple and tied with a miller's knot.

Clarification of Cider

Clarification of cider is accomplished by the so-called pectinol enzymic process. This method is comparatively inexpensive, requires no additional equipment, and produces very satisfactory results.

Pectinol, as manufactured by the Rohm & Haas Company of Bristol and Philadelphia, Pennsylvania, is a powder which may be added directly to the freshly expressed juice. Its principal action is to break down the pectin substances in the juice, thereby producing a sediment which is easily removed by filtration or even to a considerable extent by siphoning. To get the active agent of the Pectinol into solution, place the required amount in a gallon glass jug and fill the jug to about three-fourths or more of its volume with warm water or cider (about 100°F) and shake well at intervals for about 20 minutes. This mixture may then be strained through a double thickness of cheese cloth into the freshly pressed barrel or tank of cider and the residue discarded.

Pestinol, like other enzymic preparations, requires time to complete its work or to complete the chemical reaction in the cider. The rate at which the reaction takes place also depends on the temperature of the cider. The Table I, supplied by the manufacturer, suggests the quantities (in ounces) that should be used for each 100 gallons of cider for different temperatures and different periods of time.

TABLE 1—TIME ALLOWED FOR ACTION OF PECTINOL

Temperature	5 hrs.	15 hrs.	30 hrs.	48 hrs.
40°	...	30	15	10
60°	54	18	9	6
100°	14	5	----	----

These rates are essentially the same as those used at Michigan State College during the past two seasons. The usual practice at the College is to

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grind the apples and express the juice during the afternoon. The enzyme is usually added to the cider during the latter part of the afternoon, the cider placed in cold storage over night and filtered the following forenoon after some 15 to 16 hours have elapsed. Twelve ounces of Pectinol to a 50-gallon barrel usually gives good results under these conditions.

Filters are designed to make use of a "filter aid" which is thoroughly mixed with the fruit juice. These filter aids are usually diatomaceous or infusoral earths of varying porosities which build up cakes on a supporting medium, such as a cloth of proper density, thru which the fruit juice is forced under pressure. As the juice passes through this porous filter cake, the broken down colloidal matter and sediment are collected while the clear juice passes through. A filter aid known as Super-cell Hyflo, manufactured by the Johns-Manville Company of Cleveland (branch in Baltimore) has given very satisfactory results in numerous tests at the College.

The amount of Hyflo to use varies considerably with the varieties of apples used in making the cider, with the maturity of the apples, and with the clarification treatment. For most conditions, the best results are obtained by using about one pound to 30 gallons of cider. When the clarification is not as complete, or when the cider is made of very ripe apples, the proportions may be increased to one pound to 20 gallons. When clarification is exceptionally good, as little as one pound of Hyflo to 40 gallons may suffice.

The Hyflo must be thoroughly mixed with the cider and it may be necessary to agitate the mixture from time to time. Where large quantities of cider are made, a motor driven agitator may be installed for the supply tank.

It is necessary to let some cider (about two gallons) run through the unit before collecting any for use, in order to build up a filter cake in the tube. As the filter is used, the filter cake gradually becomes clogged with material removed from the cider and the rate of flow is reduced. The rapidity of clogging depends largely upon the amounts of "Hyflo" used, the amount of suspended matter and sediment in the cider, and the extent to which clarification has taken place. The filter cake should be a solid, porous, light chocolate-brown mass. If there is not enough Hyflo, the cake will be a dense, dark, and slimy.

With small pressure head (six to eight feet net), the tube must be cleaned about every 20 to 40 gallons. With more head this may be extended considerably. Since the longer the cake has been building up, the more sparkle will be noticed in the filtered juice, it is advisable to run as long as possible. Cleaning is very simple. The tube is untied and may be shaken out and rinsed, but where running water is available, the tube can be held over the end of the tap and quickly flushed out. Only a few minutes are required to take off, clean, and replace the unit.

Where a large quantity of cider is to be run, a high rate of flow can be obtained by assembling a battery of the specified units. All may empty into a single header trough if arrangement is made to prevent the mixing after a unit has just been cleaned and if the cake has not had time to build up again.

This discussion has been limited to the processing of cider, but with some modifications, this method of filtering has a widespread use. It can be made to work with the other fruit juices, vinegar, and other home products.

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FALL APPLICATION of Granular AERO Cyanamid has the advantage of getting the job out of the way of Spring work. Moreover, in the Spring unfavorable weather may interfere with applying the nitrogen early enough to produce the best results.

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Directions for Clarifying and Filtering Cider

1. Add Pectinol RA (Obtained from Rohm & Haas Co., Bristol, Pa.) to freshly expressed cider at rate of 20 to 30 ounces per 100 gallons. The Pectinol powder should be placed in a jug with warm cider or water (about 100° F), agitated at intervals for 20 minutes, and strained through cheese cloth into a barrel or vat of cider. The residue after straining should be discarded.

2. Allow about 15 hours for Pectinol to do its work (the breaking down and sedimentation of colloidal substances), when the cider will be ready for filtration.

3. Place cider in the mixing or supply tank for filtration. Thoroughly mix Hyflo filter aid (obtained from Johns-Manville Co., Baltimore) into cider at rate of two to four pounds per 100 gallons. Allow cider to run through filter aid until clear (first few gallons will contain some suspended filter aid and must be refiltered.) If cider fails to clear up, look for a leak in the system."

Circular Bulletin No. 98 (revised) entitled "How to Make, Clarify, and Preserve Cider," published by Michigan Experiment Station, East Lansing, also describes and illustrates this filter, as well as methods for clearing and preserving cider. Growers interested in commercial manufacture of cider on a large scale will be interested in Technical Bulletin No. 202, entitled—"The Commercial Processing of Apple Juice," published by New York State Agricultural Experiment Station, Geneva. This bulletin states that "pasteurizing of apple juices at 170°F for 20 minutes was found to give sterile products in which "scorching" (or cooked taste) was not evident." However, this may vary slightly with variety of apple juice, and also if the juice is in a bottle or other container, it must be rememered that the *juice* must be heated to 170°F and not the bottle only. Probably the best method would be to place a thermometer in a bottle or other container of the juice, and count the time of heating from the time that the *juice* reached 170° inside the container. Seal the container immediately after heating is finished. There is also a "flash method" of pasteurization in which the cider is run through a heated tube, coming out as pasteurized juice, ready for bottling.

Some growers are so located that they can get as much for low-grade apples in local trade, as they could get for the cider pressed from these apples, but many growers have more low-grade fruit than the local market can consume, and they realize the danger of throwing this stock on the open market. There is a movement going on at the present time, in which the Federal Government is planning to establish regional laboratories to work out methods for using low-grade and surplus farm products as by-products. The various Experiment Stations and Horticultural Societies have asked that one of these laboratories be located in the East where apples would be one of the products to be worked upon. In the meantime, our best method would be to work toward improving our cider. Since people buy with their eyes, and look for bright, well-colored apples, it is probable that they will also be attracted by clean, bright and sparkling cider, instead of the old-fashioned muddy product that used to be in demand.

It's time to drain and clean the spray machinery now before freezing weather.

COST OF GROWING AND HARVESTING APPLES *

F. H. BALLOU

"Ohio Experiment Station: Bimonthly Bulletin, Vol. 23, No. 192, May-June, 1938.

This project of keeping an accurate account of all cash expenditures for labor, materials, and more or less closely related incidentals in apple production was begun in the spring of 1924. It has now continued during a period of 14 consecutive years. (1924-1937).

The location of this long-term experiment is in a *very hilly* section of southeastern Licking County, Ohio, on *steep slopes and hilltops*. The ground on which the 20-acre test block of trees is situated was purchased by the present owner but little less than 40 years ago at the price of $30 per acre. For many years this land has been subjected to generally prevailing unprofitable and ruinous practices of grain and forage farming.

The age of the greater part of the orchard at the beginning of this experiment in 1924 was 12 years. The varieties of apples predominating were Ensee, Grimes, Jonathan, Stayman and Rome. A small block of trees, principally of Jonathan, Rome and Stayman was in its twenty-fifth year. A still smaller section of the ground, about 2½ acres, was but newly set when this project was started and contained about 100 trees of Red Delicious which had been planted as stocks upon which to top-graft other varieties as such were desired for trial. This report covers expenditures on and yields of fruit from the entire block of 20 acres, regardless of age and bearing capacities of the trees.

The orchard has been fertilized annually with promptly available commercial nitrogenous fertilizers, first with sodium nitrate, next with ammonium sulfate, and in more recent years with cyanamid. The rate of application has been approximately ¼ pound of fertilizer for each year of age of the trees composing the different plantings included in the orchard as a whole. The fertilizing materials have been applied very early in spring or late in autumn in broad circles or belts beneath and a little beyond the outer extremities of the trees during the earlier years of their development. As the spread of branches has gradually become greater and the feeding root systems have extended outward into the centers of the spaces between the trees, the fertilizers have been spread more and more nearly over the entire surface of the ground. The small, circular areas immediately around the bases of the trees have been the only part left unfertilized.

The plan of culture of this orchard has been to encourage dense coverage of the soil by heavy, annual growths of vegetation, principally bluegrass. No mulch from outside sources ever has been used, because the orchard is located in a region where little straw or other surplus vegetation is procurable. The cultural plan, therefore, has been to build up an effective grass mulch by mowing the grass in June and again in September. Production of apples in the orchard under discussion has been unfailing and sufficiently heavy to render advisable much more thinning of fruit than it has been possible to do with the limited help available. Size and color of the apples likewise have been all that reasonably could be expected. Obviously, under such cultural treatment, erosion has been avoided during the 14-year term covered by this report. Nor will there be any loss of soil in the future, so long as the present cultural plan is followed.

Spraying for prevention of injury to fruit and foliage by fungous diseases and insects has been done with strict regard to both timeliness and

thoroughness of application. In only two instances during the past 14 years did exceptions occur, and these in only small parts of the orchard.

Portable power spraying outfits of different types were used exclusively previous to and during the first two seasons of the orchard. For a 5-year period following, dusting was given exacting trials in comparison with spraying. New equipment for both methods of treatment was purchased. During the more recent period of 8 years, heavy-duty stationary spraying machinery has been used exclusively and with much satisfaction.

Annual or biennial pruning, as seasonal conditions and different varieties have rendered advisable, has been practiced during the 14 years. Rather light pruning has been favored, just sufficient to remove dead, dying, broken, crowding, and no longer useful branches; to prevent the trees from attaining inconvenient heights; and to admit sunshine to all parts of the trees. Such pruning makes efficient spraying much easier.

During a considerable period of years, providing there are no serious crop shortages, the annual orchard costs of growing apples up to the time they are ready to be harvested are more nearly uniform than are any of the other divisions of expenditures. This is true because whether there are moderate or generous yields, the costs of pruning, fertilizing, spraying and mowing, without much variation, must be borne annually. It is possible, however, that a serious exception may occur occasionally, as in a season of scant production or almost complete failure of the crop.

Next, perhaps, in uniformity of costs are the items of picking the apples, moving them from the orchard to the packing house, sizing, sorting and packing. Expenditures for these operations depend largely on the cost and quality of labor, and on the proportion of the crop that may be sold locally for immediate use at harvest time. The proportions of the crops that have to be packed carefully for cold storage, as well as sized and graded, add several cents per bushel to the cost of handling.

In no division of expense for apple production and handling are the costs so great or so variable as in that for packages, transportation, cold storage, and the like. Without exception the greater fluctuations of cost in this classification are due to widely ranging expenditures for packages. In seasons of general or even local scarcity of apples, a brisk demand from near-by sections usually results, and the same containers, new at the outset, may be emptied and refilled a number of times during the period of harvesting and grading. In seasons of widespread overproduction, a much greater supply of packages with all the modern accessories must be provided. These all pass on to cold storage and to the ultimate dealers and purchasers. Cold storage, however, is the greatest single item of expense with which the apple grower has to contend.

Omitting a table of figures the following averages are reported:

	Cost of Growing *	Cost of harvesting and packing **	Cost of packages, trucking, storage, etc.	Overhead expenses ***	Total cost of crops
Average cost per bushel per year, cents	17	18	24	10	69

* The cost of growing includes pruning, fertilizing, spraying, thinning, and all materials entering into production of the fruit in the orchard.

** The cost of harvesting includes picking, hauling the apples from the orchard to the packing house, sizing, sorting, packing, and supervision of packing and salesrooms.

**** Overhead costs include interest on investment in orchard land and equipment, depreciation of value of equipment, repairs, taxes on assessed value of land and equipment, etc.

There is wide variation in annual overhead expenses. These variations are due principally to purchase of larger and more expensive orchard equipment, and to charging against the value of such equipment, annually, a constant eprcentage in allowance for depreciation. A rate of 10 percent plus repairs and replacement of parts has been charged against mechanical equipment and 5 percent plus repairs, on buildings that are necessary in handling crops of fruit and housing orchard equipment.

Fall Use of Nitrogen Fertilizer

If use of nitrogen fertilizer is desired, this fall, it should be applied as soon as possible, and not later than November 15th. If the trees were not fertilized in the spring, and may not have grown as well as was desirable, nitrate of soda may be the best fertilizer to use, as it is quickly available to the tree. If the trees have grown well, and such growth is to be maintained, any of the nitrogen-carrying fertilizer materials may be used.

To review the subject, the fall use of nitrogen fertilizer has the advantage of preventing delay in color or ripening that may happen and has happened following spring applications of nitrogen. It does have the great advantage of getting that fertilizer spreading job out of the way before spring, and the trees are in just as good shape as they are following spring application. On lighter soils, nitrate of soda may leach out of the soil, so is best applied in spring, on such soils.

If complete fertilizer was not applied to the sod orchard, better get it on within the next week or two, or delay it until spring. A 4-12-4 or 4-16-4 mixture using from 200 to 400 pounds per acre, is advised. On legume sods, an 0-16-4 mixture may be used. Some growers have had unusual responses in cover crop growth after using complete fertilizers on the cover crop.

WANTED—FOR SALE

One grower wants a good used cider press. Another grower has a used fruit polisher for sale. He has installed a larger one. Write A. F. Vierheller, College Park, Md., for particulars.

SPRAY RESIDUE TOLERANCE CHANGED

A letter dated September 19, 1938, issued by H. A. Wallace, Secretary of Agriculture, states that the lead residue tolerance on fruits has been increased from 0.018 grains per pound to 0.025 grains per pound. The arsenic tolerance is unchanged and remains at 0.01 grains per pound of fruit. This is good news to all growers, as it gives a little more leeway in applying sprays for control of late brood codling moth.

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